

TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD

SEMICONDUCTOR INDUSTRY

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COMPANY REPORT

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Market leader

...with expected future challenges

- **Expected growth in Taiwan.** Taiwan is a strong economy in the APAC region and has a GDP per capita (PPP in USD) which is three times higher than in China. With a relative small population, Taiwan represents strong economic performance which is expected to remain until 2022.
- **Increasing technological trends.** Technological trends, driven by the Internet of Things, Artificial Intelligence and Industry 4.0 will shape many industries on a global scope, and will drive growth in the semiconductor industry.
- **Macroeconomic challenges remain.** Although many agreements with China exist which theoretically allow trade easing, China continues to refuse to cooperate with Taiwan on international ground limiting its opportunities for international trade.
- **High CAPEX and R&D Expenses.** High CAPEX and R&D expenses in the foundry business are considered normal to maintain competitive advantage in exploring new wafer technologies by investing in new Fabs.

Company description

Taiwan Semiconductor Manufacturing Company, Ltd. (TSMC) was founded in 1987 in Taiwan and manufactures integrated semiconductor circuits. It provides services in the areas of wafer manufacturing, wafer probing, assembly and testing, mask production and design services. TSMC offers 9,275 different products with 249 distinct technologies to 449 different customers and employs 47,000 people. Its products serve a variety of industries such as the computer, communication, consumer electronics, automotive and industrial equipment.

Recommendation: **HOLD**

Vs Previous Recommendation **BUY**

Price Target FY17: **233.8 NT\$**

Vs Previous Price Target **255.2 NT\$**

Price (as of 2-Jan-18) **232.5 NT\$**

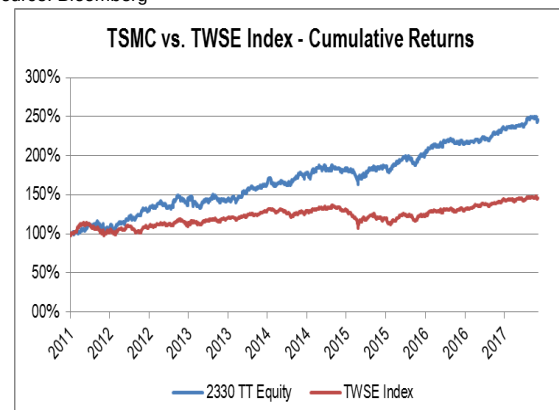
Source: Bloomberg

52-week range (NT\$) **179.0.-245.0**

Market Cap (NT\$m) **6,146**

Outstanding Shares (m) **25,930**

Source: Bloomberg



Source: Bloomberg

(Values in NT\$)	2016	2017E	2018F
Revenues	947,938m	1,041,474m	1,132,682m
EBIT	320,048m	391,333m	425,605m
NOPLAT	327,725m	339,302m	368,990m
Net Profit	334,338m	346,362m	376,050m
EPS	12.9	13.4	14.5
P/E	14.1	13.6	11.5

Source: Group's report and analyst estimates

THIS REPORT WAS PREPARED EXCLUSIVELY FOR ACADEMIC PURPOSES BY ANTON KOHNZ, A MASTERS IN FINANCE STUDENT OF THE NOVA SCHOOL OF BUSINESS AND ECONOMICS. THE REPORT WAS SUPERVISED BY A NOVA SBE FACULTY MEMBER, ACTING IN A MERE ACADEMIC CAPACITY, WHO REVIEWED THE VALUATION METHODOLOGY AND THE FINANCIAL MODEL.
(PLEASE REFER TO THE DISCLOSURES AND DISCLAIMERS AT END OF THE DOCUMENT)

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Executive summary

Taiwan will remain main operating location.

Taiwan Semiconductor Manufacturing Co Ltd. is a pure-play semiconductor foundry with headquarter in Hsinchu Science Park, Taiwan. The company designs, manufactures and markets semiconductor products according to clients' needs granting a competition-free business with its customers.

TSMC has the highest market share of ca. 58% in the pure-play foundry business worldwide.

In the foundry business, TSMC has the highest market share of 58% in 2016 with profit margins of approximately 34% over the past five years. New opportunities will arise with the latest technology developments in the industry driven by the Industry 4.0, the Internet of Things and Artificial Intelligence shaping almost all industries on a global scale.

Future competition can and will arise from IDM's.

Although the company operates in a "competition-free" environment with big players in the semiconductor industry due to the foundry business, competition can arise from other foundries and from Integrated Device Manufacturers (IDM's), which perform their own R&D activities, including marketing and selling efforts.

Valuation

Price target of NT\$ 233.8 which is a capital gain of 0.6%.

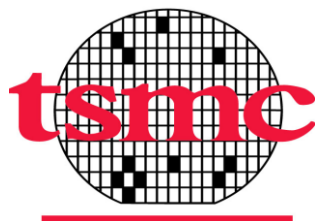
Performing the Discounted Cash Flow (DCF) analysis, the TSMC's target price was estimated to NT\$ 233.8, implying a capital gain of 0.6% compared to the current price of NT\$ 232.5.

Industry-wide technological developments and the increasing rate of semiconductor content in electronic devices will shape the industry.

The main growth drivers will be further technological developments in the communications, computer, automotive, data processing and consumer electronics industry. Moreover, increasing market shares of fabless semiconductor companies and IDM outsourcing coupled with in-house expansion of Application-Specific Integrated Circuits will drive revenues in the semiconductor industry, especially for companies with a pure-play foundry model such as TSMC's. With a forecasted real GDP of 2.5% in 2022 and an inflation rate of 2% the perpetuity growth rate resulted in 4.5%.

Considering an expected total return including expected capital gains between 0% and 15% over a 12-month period, the outcome results in a "HOLD" recommendation.

Exhibit 1: TSMC logo



Company overview

Taiwan Semiconductor Manufacturing Company Limited (TSMC) was founded in 1987 in Hsinchu Science Park, Taiwan where it is currently headquartered. TSMC operates in the semiconductor industry and is running 10 manufacturing facilities (Fabs), in which it produces diverse semiconductor technologies. As of today TSMC offers 9,275 different products including 249 distinct technologies, has 249 customers and employs ca. 47,000 people. Through its offices in North America, Europe and the APAC region, TSMC provides customer services in the areas of account management and engineering.¹

Company description

Exhibit 2: TSMC's market share

▪ Business Model

Share of Total Sales	2014	2015	2016
TSMC	59%	59%	58%
GlobalFoundries (U.S.)	10%	11%	11%
UMC Group (Taiwan)	10%	10%	9%
SMIC (China)	5%	5%	6%
TowerJazz (Israel)	2%	2%	3%
Powerchip (Taiwan)	3%	3%	3%
Vanguard (Taiwan)	2%	2%	2%
Hua Hong Semi (China)	2%	1%	1%
Dongbu HiTek (S.Korea)	1%	1%	1%
SSMC (Singapore)	1%	1%	1%
Others	5%	5%	5%
Total	100%	100%	100%

Source: IC Insights

TSMC has a pure-play foundry business model and focuses on the manufacturing process of semiconductor technology according to clients' needs. Therefore, the company sells products under its own brand name and does not interfere with the design or manufacturing processes of its clients which ensures a non-competitive relationship. It translates in an advantage compared to its competitors who market their products under their own brand.

Comparing the market share of TSMC to its direct competitors in the pure-play foundry business one can say that it has maintained strong market share performance historically and is expected to keep a market share of more than 55% in the near future.

The production facilities are predominantly located in Taiwan and the residual is located in the USA and Shanghai. Due to the interconnected network of semiconductor suppliers in Taiwan, TSMC is able to transfer engineers from one manufacturing site to another which leads to a competitive advantage through fast and effective process optimizations.

The diverse customer base allows TSMC-manufactured semiconductors to be used in a wide variety of applications covering various segments of the automotive, consumer electronics, data processing industrial and the semiconductor industry itself.² This leads to a global risk distribution regarding the market demand and to high capacity utilization levels and profitability.

¹ The APAC region includes Japan, China, South Korea and India

² TSMC annual report 2016

▪ Subsidiaries and Affiliates

Exhibit 3: subsidiary logos



Vanguard International Semiconductor Corporation (VIS) provides integrated circuit foundry services to fabless clients. VIS was founded in 1994 and produced mainly DRAM and other types of memory IC's until 2004. After that VIS became a pure-play foundry company like TSMC. Currently, TSMC owns 28.3% of equity interest. VIS and TSMC have a mutual agreement of VIS providing TSMC with fixed rates of wafers which TSMC is contracted to use within a specific monthly range. In addition, this agreement includes fixed discounts by TSMC to VIS on the actual selling price. Moreover, VIS has license rights on TSMC technologies and certain information on which TSMC receives royalty payments. In 2016, TSMC purchased goods from VIS with a value of NT\$ 6.7bn, which is equivalent to 1.4% of TSMC's total cost of revenue.



Xintec, Inc. was founded in 1998 and produces three dimensional wafer chip packages and offers optical sensor chip-scale packages for applications used in image sensors for phones, notebooks and automotive. Xintec supports TSMC's image sensor manufacturing business through business agreements. As of 2017, TSMC owned approximately 41.2% of equity interest of Xintec incurring manufacturing expenses equivalent to 0.3% of TSMC's total cost of revenue.



Systems on Silicon Manufacturing Company Pte. Ltd. (SSMC) is an 8 inch wafer fabrication founded in 1998 and is a joint venture of NXP Semiconductors N.V. and TSMC.³ Its main business operations are providing wafer fabrication solutions through Embedded Flash, Analog and High Performance Mixed Signal, and Sensor processing technologies. SSMC produces wafers for TSMC which owns 38.8% of SSMC. TSMC has a technology cooperation agreement including licenses of IP rights. In 2016, TSMC purchased goods equivalent to 0.7% of total cost of goods sold (COGS).



VisEra Technologies Company, Ltd. was founded in 2003 and develops optical semiconductor components offering image sensor foundry solutions with specialization in color filters, micro lenses and wafer level quantum efficiency testing solutions. TSMC entered into a shareholders' agreement with VisEra to form a joint venture in Taiwan to provide back-end manufacturing services to customers.

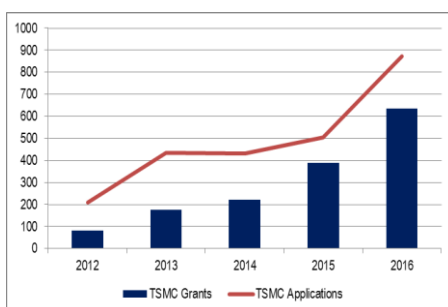
▪ Research & Development

Recent trends such as the Internet of Things, e-mobility or high-performance computing increase customer demand for new technologies and lead to breakthroughs in the semiconductor industry. Therefore, investments in R&D in

³ TSMC annual report 2016

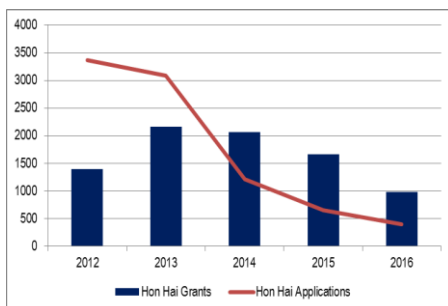
this specific sector are crucial to sustain competitive advantage. Key technological requirements for devices and products are to be faster, smaller and more power efficient. Previous investments in R&D allowed TSMC to provide its customers with advanced technologies such as the 28-nm, 20-nm, 16-nm and 10-nm technology. In addition TSMC invests in the recent 7-nm and 5-nm technology to maintain its leading position in the sector. Further development consortia, customer collaborations and the support of equipment vendors will determine the Research and Development success. In the third quarter of 2017, TSMC announced the fabrication process of a 3-nm Fab with a CAPEX of more than USD 20bn to a yet unspecified date.

Exhibit 4: TSMC's IP grants and IP applications



Source: Taiwan Intellectual Property Office

Exhibit 5: Hon Hai's IP grants and IP applications



Source: Taiwan Intellectual Property Office

■ Intellectual Property

An adjunctive subject regarding R&D is the preservation and protection of Intellectual Property (IP) and Know-How. Especially in the case of TSMC which delivers integrated circuits to clients from the semiconductor industry itself but also to companies which operate in various sectors in an international context. The independent development of new technologies, patents, software and Know-How will guarantee a leading position and will increase the ability to compete with competitors and will ensure positive long-term growth supported by mutual exchanges of intellectual property through subsidiaries and affiliate companies. Nonetheless, patent theft rates are high in Asian countries, especially in China, Taiwan or Korea.

The number of Taiwanese patent applications decreased by 1.6% to 72,442 in 2016 which is due to corporate's portfolio realignment seeking for new strategies regarding IP. These strategies favor quality over quantity and may indicate that corporates buy important patents and sell those they do not require rather than producing their own. This is the case for TSMC and Hon Hai which are reshaping their IP strategies by becoming market makers and more innovative instead of maintaining their strong position as contract manufacturers.

Share price Performance and Shareholder structure

Taiwan Semiconductor Manufacturing Co Ltd. is publicly traded on the Taiwan Stock Exchange (2330:TT) and its American Depositary Shares (ADS) are traded on the NYSE (TSM:US). TSMC has a total market capitalization of approximately NT\$ 6,146bn.

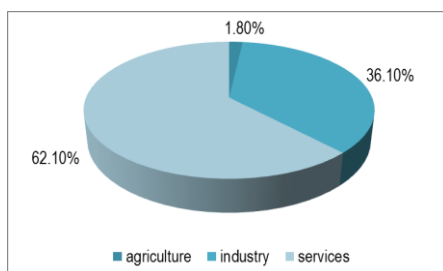
TSMC is listed in the Taiwan Stock Exchange since September 5, 1994 and its ADSs have been listed on the NYSE since October 8, 1997. Compared to the index, the TSMC has a cumulative return of 248% on January 3, 2018, while the TWSE index has a cumulative return of 147%.

Currently the company has 25,930 million common shares outstanding. The shares of the company with ownership of five percent or more are distributed to the National Development Fund (6.38%), Capital World Investors (6.12%), and BlackRock, Inc. (5.10%). All Directors and Executive offices of the group, except the National Development fund, own 0.92% of the total outstanding common shares. Investors from outside the Republic of China (R.O.C) are obliged to hold their common shares through their respective authorities by keeping the same voting rights.⁴

The Sector

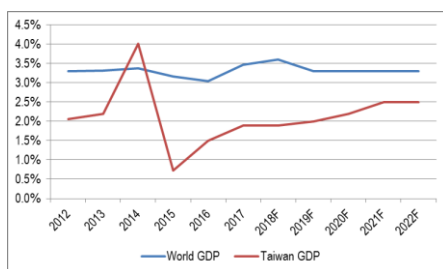
Taiwan

Exhibit 6: Taiwan's GDP composition by sector



Source: CIA – Central Intelligence Agency

Exhibit 7: historical and forecasted GDP Taiwan vs. GDP world



Source: IMF, 2017

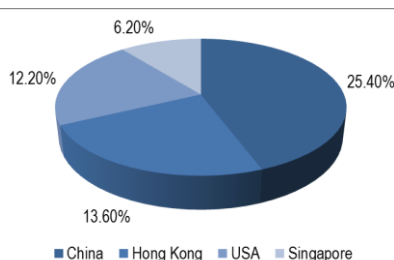
Taiwan is an island state in East Asia. The country held its first direct presidential election in 1996 and in 2000 it underwent its first peaceful transfer of power from the Nationalist Party (KMT) to the DPP.⁵ Ever since, the island grew economically whereas main political issues on the topic of Taiwan's sovereignty and its domestic priorities for economic reform and growth with China remained. Industrial manufacturing companies drive most of Taiwan's exports. This leads to higher exposure to global fluctuations in demand, but minimizes the risk of sole dependency on few importers. Other long-term challenges arise from low birth rates, aging population, diplomatic isolation and high competition from China and other APAC nations.

Taiwan's GDP is approximately 1.9% compared to the World GDP of 3.5%. Nevertheless, forecasts show an increase of GDP to 2.5% by 2022. This growth is mainly driven by the strong global economic growth and by exports in electronics. Furthermore, the Taiwanese government loosened fiscal policies including the implementation of a forward-looking infrastructure plan and an increase in public-sector wages.

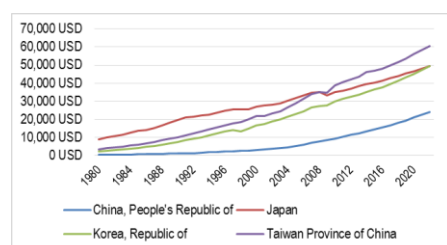
The Economic Cooperative Framework Agreement (ECFA) was signed with China in 2010 to reduce tariffs and trade boundaries between the two countries. Taiwan benefits from this agreement as it is highly export oriented and as the agreement offers incentives for international corporations to use Taiwan as a "trade and investment springboard" to the East Asian market allowing access to global trading, especially with Europe.

⁴ TSMC annual report 2016

⁵ Central Intelligence Agency

Exhibit 8: Taiwan's main export markets (2015)

Source: CIA – Central Intelligence Agency

Exhibit 9: GDP per capita - current prices (PPP; international dollars per capita)

Source: IMF, 2017

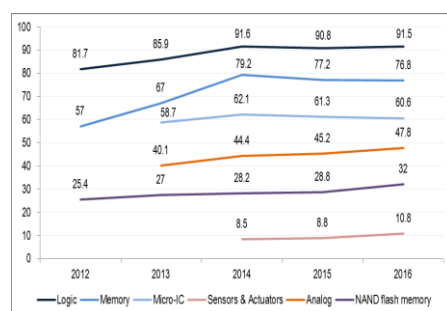
Following the ECFA, Taiwan signed a free trade deal with New Zealand and Singapore in 2013. This was a major step in Taiwan's history, as this agreement is the first of its kind without any diplomatic involvement.

With the presidency of Tsai Ing-wen in 2016, greater economic integration with South and South-East Asia took place through the Southbound Policy Initiative with the future objective to join the Trans-Pacific Partnership and bilateral trade deals with partners such as the US.⁶

The island owns the world's fifth largest foreign reserves and has a trade surplus with countries such as China and the U.S. China is Taiwan's second largest importer, after Japan. Foreign direct investments are mainly made in China due to loosened rules regarding the governing of Chinese investments, which allow for greater market access for Taiwanese investors to China.

In 2012, the Taiwanese Central Bank signed a Memorandum Of Understanding (MOU) regarding currency settlements with China. This allows for direct settlement of Chinese Renminbi (RMB) and the New Taiwan dollar (NT\$) across the Strait, and turned Taiwan into a local RMB hub.

Semiconductor Industry

Exhibit 10: Semiconductor Market Segment Sales in USD bn.

Source: SIA – Semiconductor Industry Association

Worldwide revenues in the semiconductor industry totalled USD 338.9bn in 2016 which is an increase of 1.1% compared to 2015, and is the industry's historically highest sales number.⁷ Factors such as macroeconomic expansion, recent technological industry trends and the increasing usage number of semiconductors in technological devices were main drivers for market growth. The largest semiconductor sales category, occupying approximately 27% of the whole semiconductor market was logic with sales of USD 91.5bn, followed by Memory (USD 76.8bn) and micro-ICs (USD 60.6bn). The fastest growing segment was sensors and actuators with an increase of 22.7% compared to 2015. NAND flash memory reached USD 32bn in sales in 2016 resulting in an 11% increase compared to the previous year, followed by digital signal processors (USD 2.9bn), diodes (USD 2.5bn) and small signal transistors (USD 1.9bn).⁸

China is the country with strongest sales growth of 9.2% for semiconductors, followed by Japan (3.8%). Other global markets saw decreases in sales

⁶ Central Intelligence Agency⁷ World Semiconductor Trade Statistics organization⁸ World Semiconductor Trade Statistics organization

Semiconductor sales are expected to grow internationally covering various industries.

compared to 2015 such as APAC (-1.7%), Europe (-4.5%) and the Americas (-4.7%).⁹

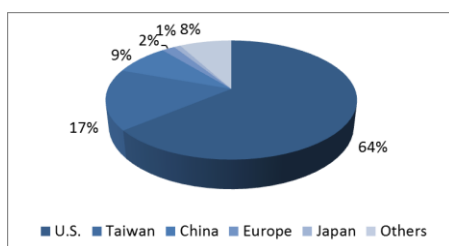
Semiconductor sales are expected to reach USD 400bn by the end of 2017, marking the historically highest sales figure ever generated resulting in a 20.6% overall increase compared to 2016. Further growth in the semiconductor market is expected across all regions driven by high demand for memory products.

Competition

TSMC's competitors are foundry service providers and integrated device manufacturers which devote their manufacturing capacity to foundry operations. The main areas of competition are process technologies, manufacturing excellence, customer service and service quality. This includes early technology readiness, better quality, faster yield improvement and shorter cycle time.

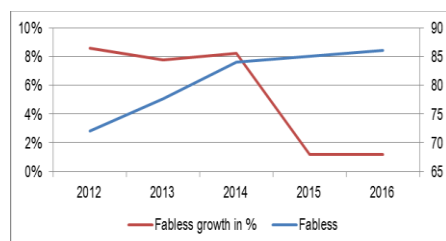
Semiconductor competitors' specifics

Exhibit 11: IC sales – Market Share by country among Top 50 Fabless companies in 2015



Source: McClean Report 2016, IC Insights

Exhibit 12: Fabless IC sales worldwide in USD bn.



Source: Statista

Integrated Device Manufacturers (IDM's) are semiconductor companies which design and manufacture their own products and conduct their own R&D including research and marketing spending. Until 1980, all semiconductor companies followed the business model of an IDM. As operating and owning manufacturing assets became expensive the concept of outsourcing was implemented resulting in the occurrence of foundry model companies. Industry average EBIT margins for IDM's are approximately 12%. COGS are the largest portion of expenses reaching approximately 58%, followed by R&D expenses (15%) due to owned production facilities. Furthermore, the design of products and customer services are very important to IDM's.

Fabless companies are competitive in the semiconductor industry and focus solely on the semiconductor design and do not operate in their own Fabs. The US is a dominant player regarding sales figures. In 2015, the top 15 American fabless IC suppliers accounted for 76% of the total amount of fabless IC sales. Fabless semiconductor firms are considered having good profitability with average EBIT margins of approximately 10%. Depreciation rates and fixed assets are relatively low at around 5% of revenues. As fabless companies are dependent on sourcing chips from third parties, COGS is relatively high and amounts to approximately 50% of total revenues. Furthermore, marketing and selling expenses are high as their business is focused on design of chips and customer access. To sustain a leadership position, strong IP positions supported by governmental policies are necessary.

⁹ World Semiconductor Trade Statistics organization (APAC excluding China and Japan)

Compared to IDM's and fabless companies, TSMC has COGS of 50% of revenues in 2016, due to the foundry business model as it sells similar products to a variety of customers. Its R&D and marketing expenses of 8% and 1% respectively show lower rates compared to IDM's and Fabless companies, as TSMC is able to turn its focus on latest technologies by reducing investments on more outdated ones. These factors lead to a higher EBIT-Margin of 40% in 2016 compared to its peers.

Competitors

Exhibit 13: Competitor logos



Intel Corp. – Intel Corp. was incorporated on March 1, 1989 and is engaged in designing and manufacturing products and cloud technologies.¹⁰ The company controls 80% of the market for and makes chips for smartphones, tablets as well as embedded semiconductors for the industrial, medical and automotive market.¹¹ On the contrary to TSMC, it falls under the category integrated device manufacturers for integrated circuits (IC IDM).

Intel Corp. reported record revenue of about USD 59 bn. in 2016, which is a 7% increase compared to the previous year and has a market cap of USD 216bn. The reason for the decrease in net income compared to the previous year was mainly the increase of COGS of ca. 2% to 39.06% of revenues.



NVIDIA Corp. – Nvidia Corp. was founded in 1993 and produces graphic processors and media and communication devices. The company operates two segments such as the GPU and Tegra Processor segment. GPU products are focused on specific markets and include graphic chips for gamers and GRIDs for visual users.¹² Nvidia operates as a Fabless Semiconductor company, which allows it to focus more on R&D, marketing and customer support. Moreover, maintenance costs of upgrading fabrication facilities are kept to a minimum.

The company reported record revenues of USD 6.91bn in 2016, which is a 37.9% increase compared to the previous year with a 171.34% increase in net income to USD 1.67bn. Growth was mainly driven by the data center business, especially through the graphic card business which was driven by the Artificial Intelligence trend. Nvidia Corp. has a market cap USD 117bn.



Texas Instruments Inc. – Texas Instruments produces analog and embedded processors for specific electronic devices. The main operating segments are automotive, industrial machinery, consumer electronics, communication devices and calculators. The analog business accounts for two-third of sales and includes

¹⁰ Reuters

¹¹ Intel Corp. annual report 2016

¹² Reuters

high-volume analog and logic products, power management semiconductors and data converters.¹³

China is the biggest single market for Texas Instruments, accounting for ca. 45% of revenues with other APAC countries (including Japan), whereas the US generates about 12% of TI's sales.

Texas Instruments is investing in processors for the main business segments, and is moving to produce more chips on 300mm wafers, which hold more chips than the standard 200mm wafers allowing for reduction of costs by around 40%.

In its recent history, Texas Instruments has not made acquisitions, and relies solely on organic growth. The last deal of TI was the acquisition of National Semiconductor in 2011.

In 2016 revenues grew 3% to USD 13.4bn. Higher revenues and lower cost of revenue and restructuring charges helped drive net income to USD 3.6bn which is a 20% increase. The market cap for TI is at USD 103bn.



Applied Materials Inc. – Applied Materials produces flat panel TV, solar energy devices and chip making machines. It covers a wide range of the chip-making process, including the deposition, etching and semiconductor metrology and inspection equipment.¹⁴ The main segments of operation are Semiconductor Systems, Applied Global Services and Display of which Applied Materials generates around 65% of revenues. Operations are conducted in the US, Europe and the APAC region. Taiwanese customers account for ca. 25% of revenue, followed by China (21%), South Korea (17%), Japan (12%) and the US (11%). Revenues grew with 12.1% to USD 10.8bn in 2016 compared to previous year.

Furthermore, the company has developed equipment to address demands in the areas of logic, 3D NAND, patterning and advance displays. The increasing market for mobile devices has driven the development and adoption of 3D NAND flash, which is supplanting planar NAND. Applied Materials gained a 12% increase in sales in 2016 from fabrication equipment including sales to semiconductor foundries.

To keep up with the strong demand for smaller circuits, larger wafers and new technologies such as copper connectors, Applied Material relies heavily on R&D efforts with 15% sales spending each year and has a market cap of USD 56bn.



Infineon Technologies AG – Infineon Technologies AG designs, develops and manufactures semiconductors and system solutions. The company operates in the segments: Automotive, Industrial Power Control, Power Management and

¹³ Texas Instruments annual report 2016

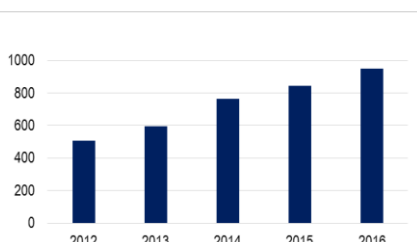
¹⁴ Applied Materials Inc. annual report 2016

Multimarket, and Chip Card Security. Especially, the Industrial Power Control segment designs, develops, manufactures and markets semiconductors for the conversion of electric energy in the medium to high power range.¹⁵

The APAC region became the largest region accounting for 46% of total revenues.¹⁶ Improved access to the Chinese and U.S. markets and strong revenue growth resulted through the acquisition of the company International Rectifier.

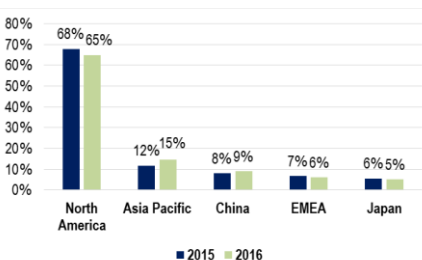
Infineon generated revenues of EUR 6.5bn in 2016 which is a 12% increase compared to the previous year out of which Industrial Power Control contributed EUR 1.01bn (16%) to total revenues. Despite a challenging semiconductor environment the company managed to achieve 7% organic growth. China has been the most important sales market accounting 24% of revenues.

Exhibit 14: TSMC's past revenues in NT\$ bn.



Source: TSMC's annual reports

Exhibit 15: TSMC's revenues by region



Source: TSMC's annual reports 2015/2016

TSMC's Performance

TSMC's revenues in the past five years have shown significant growth with a CAGR of 17.1%. The reason is the increasing number of orders from fabless semiconductor companies. Furthermore, they are driven by the increasing demand for technological devices such as in smartphones, tablets, cars and medical devices.

Although TSMC has its headquarter and most of its production facilities in Asia, most of its revenues in 2016 came from North America (65%), followed by the Asia Pacific (14.8%), China (9%), EMEA (6.1%) and Japan (5.2%). Due to the provided customer support, long-term revenue streams from existing and new clients will be guaranteed. The services provided by foundries are technologically and logistically intensive and involve frequent and high-level interactions with clients to ensure functionality of TSMC's products due to the rapidly changing technology and design of semiconductors.¹⁷ Moreover, TSMC's book value of assets rose by 17.3% to NT\$ 1.07 trillion in 2016. The book value of equity followed a similar trend, with a total increase of 13.7% to NT\$ 1.4 trillion.

¹⁵ Infineon Technologies AG annual report.

¹⁶ APAC region excluding Japan

¹⁷ TSMC annual report 2016

Financials

Revenue Drivers

The semiconductor sector especially in the case of the foundry TSMC, is linked to application markets such as, Communication (mobile devices, wireless infrastructure, wireline infrastructure, baseband processors etc.), Computers (GPU, CPU and hard disk drive controllers), Consumers (digital television, digital cameras, game consoles, application specific standard products (ASSP) for digital televisions) and Industry (MCUs, power management ICs, data converter, programmable logic devices (LPD) and flash controller). TSMC's revenues are expected to grow with a CAGR of 8.6% until 2022 based on industry data forecasts and future corporate objectives.

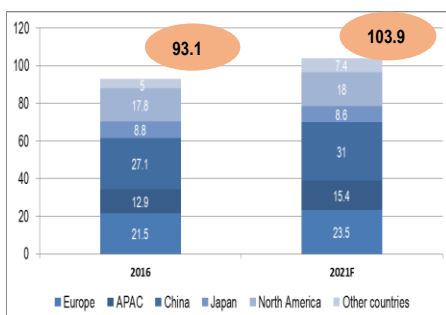
Communication – Wireless and wireline communications account for around 34.2% of chip sales. This segment includes broadband access equipment, IP and optical carrier infrastructure, WLAN, and handsets.¹⁸ Mobile data traffic volumes are continuously increasing with 8.8 billion gigabytes being transferred via cellular communications each month in 2016. According to industry experts 71 billion gigabytes per month are expected in 2022. Network providers are looking to high-performance infrastructures in order to achieve higher data rates and to improve network coverage in preparation for the exponential increase in data volumes.

Consumer Electronics – Consumer electronic semiconductors account for approximately 17.5% of industry sales and are used in TV's, videogame consoles and handhelds, portable media players and digital cameras.¹⁹ Consumers demand innovative electronic devices with advanced features. The increase in consumer demand for innovative electronic devices leads to consistent developments in product design, product manufacturing and the delivery of new products. This is necessary to overcome fast product eliminations from the market to maintain competitive advantage and to tackle growing product complexity. By 2020, consumer electronics is expected to account for USD 2.2 billion in semiconductor revenue. An increase of 2% compared to 2017 in worldwide shipments of PC's, tablets and smartphones is expected in 2018 and will reach 2.35 billion units. Furthermore, 1.5 billion smartphones were shipped in 2017 and will reach 1.73 billion units by 2021, resulting in a CAGR of 3.3%.

¹⁸ IDC – International Data Corporation

¹⁹ S&P Capital IQ – Industry Surveys Semiconductors & Equipment

Exhibit 16: Worldwide light vehicle production by region in million vehicles



Source: IHS Markit

Automotive – Most recent innovations in the automotive industry were only possible through extensive and innovative developments in semiconductor products. These developments include vision-based technology, enhanced graphics processing units (GPUs) and application processors, sensors and DRAM and NAND flash.²⁰

Long-term growth in the automotive semiconductor industry will steadily rise as the manufacturing process for automobiles will become more complex. Demand for automotive semiconductors is expected to increase in the mid-to long term covering the areas of safety, comfort and connectivity. Worldwide vehicle production is expected to grow 11.6% by 2021 implying business opportunities for semiconductor companies. Additionally, global automotive revenues are expected to grow at 4.4% p.a. and will reach USD 6.7 trillion by 2030. Hybrids and electric cars are expected to have 1.5 to 3 times higher semiconductor contents. Until 2019, a CAGR of 20.5% is forecasted regarding semiconductor material used in cars.

Semiconductor companies will continue working directly with OEMs and tier-one automotive suppliers introducing innovative features to latest industry trends. The Asian market will remain an important demand origin for semiconductors but will also become one the dominant testing location for self-driving cars and electric vehicles. This is due to the provision of large pools of potential partners for automotive ventures to semiconductor companies provided by the Chinese government. Furthermore, China increased domestic support for manufacturing companies driving innovation and investments in facilities.

Industrial – The global industrial semiconductor industry reached USD 43.5 billion in 2016, which is equivalent to a 3.8% y-o-y growth. This was mainly due to broad-based demand across the industrial electronics equipment sector. This growth has continued into 2017. Markets with significant growth were military avionics, digital signage, network video surveillance, HVAC, smart meters, traction, PV inverters, LED lighting and medical electronics including cardiac equipment, hearing aids and imaging systems.²¹ The microcontroller (MCU) market forecast indicates strong growth in the long term, reaching USD 7 billion in 2021, compared to USD 4.4 billion in 2016.

²⁰ McKinsey report on semiconductors 2017

²¹ IHS Markit

The data processing industry is expected to grow with a CAGR of 7.6% until 2019.

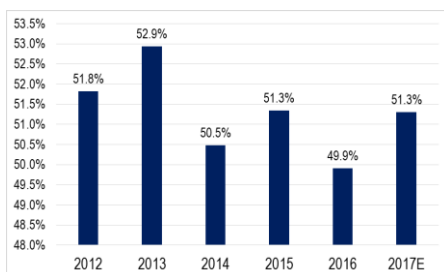
Data processing – Semiconductor sales in the data processing segment, which includes devices such as desktop PC's, notebooks, ultramobiles and tablets will continue their gradual growth until 2019.²² In contrast to the decreasing demand for desktop computers, tablet sales are expected to grow with 7.6% until 2019 with semiconductor billings exceeding those for notebooks.

Costs

TSMC's **cost of goods sold** account for approximately 51% of revenues on average historically. As the industry average for COGS in the foundry business amounts to three-fourths of revenues, TSMC manages to keep them at a relatively low level. This is due to the fact that TSMC offers multi-project wafer services allowing it to supply various customers with equal masks for the circuits provided. Additionally, this program increases time-to-market capacity for customers and includes all library and IP partners covering the latest technologies from 90-nm up to 7-nm.

The increase in COGS in 2016 compared to 2015 was mainly due to an earthquake which occurred in the beginning of 2016 resulting in earthquake losses of NT\$ 2.5bn which were included in cost of revenue.

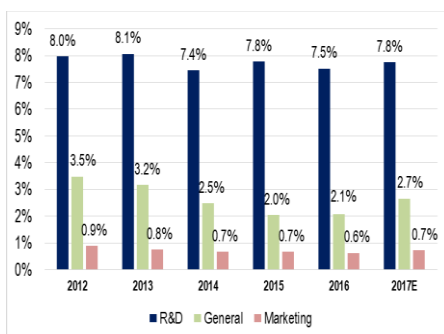
Exhibit 17: COGS in % of Revenues



Source: TSMC's annual reports and analyst forecast

Furthermore, **raw materials** used in the manufacturing processes such as silicon wafers, chemicals, gases and various types of metals amount to 10.6% of net revenues in 2016.²³ TSMC focuses on high-quality raw-material suppliers by maintaining multiple sources in order to decrease the risk of potential short-cuts. Important suppliers come from Taiwan, Germany, Japan and the US and supplied approximately 94.7% of total wafers in 2016 compared to 94.3% in 2014. Long-term relationships to wafer suppliers help TSMC to reduce price condition resulting in relatively low COGS.

Exhibit 18: Operating Expenses in % of Revenues



Source: TSMC's annual reports and analyst forecast

The **operating expenses** are mainly comprised of Research and Development, General and Administrative, and Marketing expenses.²⁴ The biggest share of all operating costs are Research and Development Expenses accounting for 73.5% of total operating expenses in 2016. Having a leading position in advanced process technologies, continuous investments in R&D expenses are important and essential to sustain competitive advantage. Furthermore, the increase in expenses was due to higher research activities in the latest nanometer technology. In 2016, TSMC invested in the 7nm and 10nm technology to be able to produce smaller processing nodes. The company is expected to spend 7.8% of revenues on R&D expenses in the near future which is more than the industry

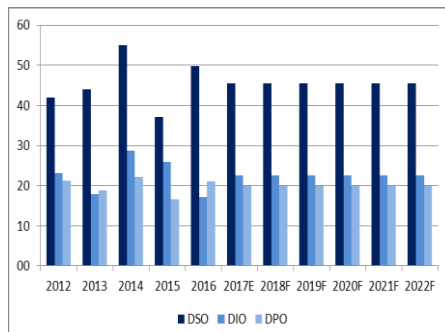
²² Pwc report 2015 – The internet of Things

²³ TSMC annual report 2016

²⁴ TSMC annual report 2016

average of 6% p.a. and is due to the fact that TSMC is a foundry with focus on production and selling processes to customers.

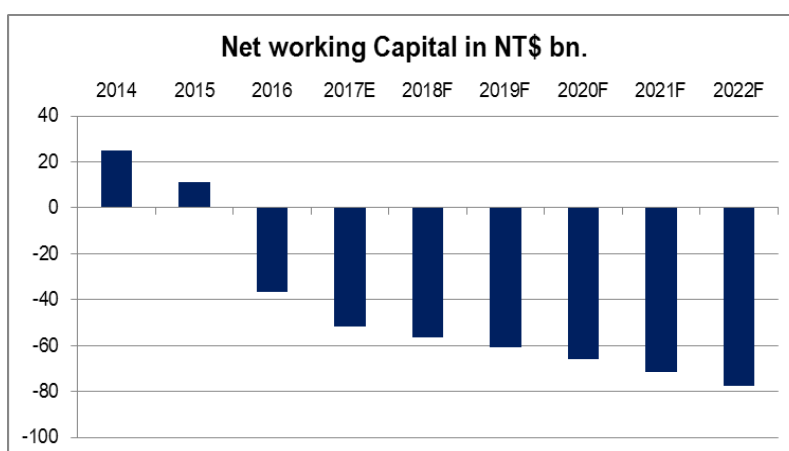
Exhibit 19: DSO, DIO, DPO outstanding



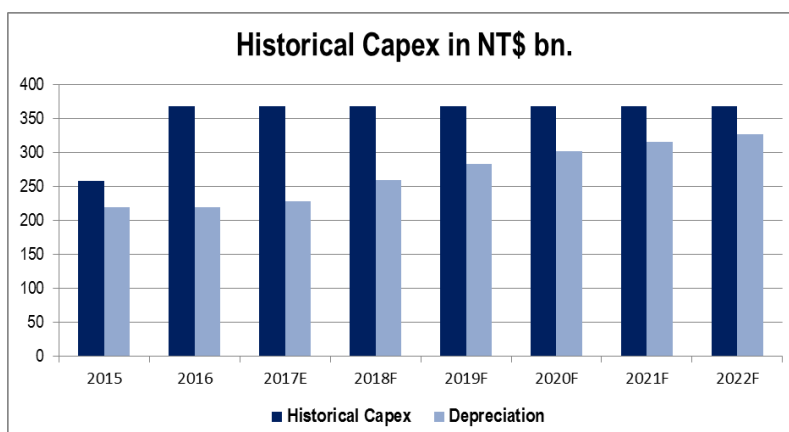
Source: TSMC's annual reports and analyst forecast

Net Working Capital and CAPEX

In order to sustain and expand its business and to adapt to future technological trends, TSMC has to build new facilities (Fabs) and to acquire additional equipment. To ensure future R&D investments, dividend payments and the financing of other existing operations, the management of **working capital** is important. Net working capital will be negative in our forecasting period as we assume constant future growth in revenues resulting in the liability side to increase as future investments will be made.



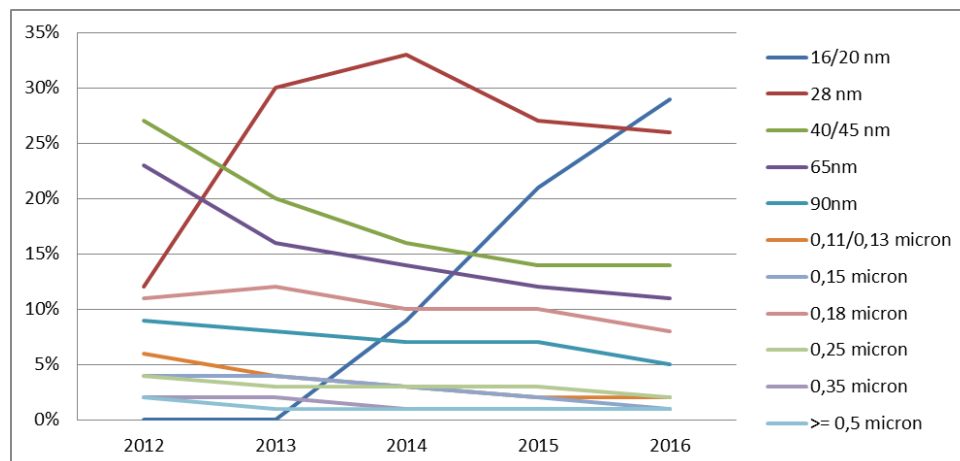
Capital expenditures in the past three years were funded by operating cash flows. In 2016, expenditures were mainly made in the acquisition of tools to develop capacities for the 300-mm wafer fab and in new process technologies such as the 16-nm and 10-nm node. Furthermore, the expansion of buildings and facilities for Fabs 12, 14, 15 and the 300-mm wafer fab in China required capital expenses.



In 2017, the further expansion of Fab15 required capital expenses for new technologies and fabrication processes to be able to satisfy customer demand

leading to a higher CAPEX in year 2016 compared to 2015. New wafer technology is a main revenue driver. To be able to provide innovative products, foundries usually invest in new fabs. The increasing focus on new wafer production at the same time lowers revenue streams from older technologies which become more obsolete in the market.

TSMC's wafer revenue from certain technologies in % of total revenues



Future CAPEX has been calculated based on the assumption of further investments in technology and fabrication processes, driven by the technological demand for smaller and faster semiconductors, such as the 7-nm and the 5-nm node of approximately USD 12bn p.a. until 2022. Silicon validation for the 7-nm node started in the first half of 2017 including the start of risk production. Volume production is scheduled for 2018.

Development activities for 5-nm in 2016 focused on test vehicle design and implementation, mask making and pilot runs. EUV lithography will be used to reduce complex multiple-patterning process steps. Risk production will start in the first half of 2019 with volume production starting in 2020.

Free Cash Flow (FCF)

The Free Cash Flow is the net cash provided or used in operating and investing activities and is a measure for the financial performance of a company. FCF in year 2016 was NT\$ 166bn and it is expected to grow to NT\$ 206bn in 2022, equivalent to a CAGR of 3.7%. This shows TSMC's strong ability to generate cash and profits and expand its business also in shorter terms allowing for investments in new Fabs to maintain high market shares in the semiconductor business.

Years	2016	2017F	2018F	2019F	2020F	2021F	2022F
FCF	166,103	181,274	180,221	193,186	193,186	193,186	206,151

Return on Capital Employed (RoCE)

The RoCE is expected to remain at approximately 20% until 2022 stating a positive position of deploying capital and its efficient usage. Compared to the estimated WACC of 7.6%, the company has been creating value in the past five years with an average RoCe of 22.2% and has a positive usage of employed funds. Moreover, it indicates a stable RoCe rate which is expected to remain until 2022.

Years	2016	2017F	2018F	2019F	2020F	2021F	2022F
RoCE	24.1%	22.7%	22.2%	21.6%	21.1%	20.5%	20.0%

WACC assumptions

Yield long-term (NT\$)	2.0%
Probability of Default (10y)	0.5%
Annualized Probability of Default	0.05%
Recovery Rate (Sr. Unsec.)	49.5%
Loss Given Default	50.5%

For valuation purposes, the weighted average cost of capital (WACC) which includes the financing structure of TSMC by considering equity and financial debt was used.

TSMC's financial debt is composed of short-term loans NT\$ 57.9m, the current portion of bonds payables and bank loans NT\$ 38.1m and bonds payable NT\$ 153.1m which are forecasted on a constant level until 2022.

Risk-free rate	1.0%
Market Return	6.8%
Market Risk Premium	5.9%
Beta Debt	0.10

The **cost of debt** was calculated as an average of the cost of debt according to the Probability of Default with the current 10-year Taiwanese Treasury bond yield, the annualized probability of default and the recovery rate of 49.5%, and Capital Asset Pricing Model with a risk-free rate of 1%, a market risk premium of 5.9% and the debt beta of 0.1. As Taiwan is considered a country with low risk, the estimated cost of debt is legitimate.

Average Cost of Debt	1.8%
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10-Year Govt. USA	2.3%
10-Year Govt. Taiwan	1.0%
USD - TWD Exchange Rate (Spot)	30.0
USD / TWD (10-Year Forward Rate)	25.5
Inflation Rate Taiwan	0.4%
Inflation Rate USA	2.0%

The **cost of equity** was calculated as an average of using the US 10-year T-Bond adjusted for inflation and considering spot rates and forward rates between NT\$ and USD and by calculating the average daily market return of TSMC including the respective annualized risk-free rate for each observation resulting in a risk-free rate of 1%.

Beta debt was estimated by taking into account comparable companies operating in the same sector and their respective ratings. An average beta debt over all comparables was used as the levered beta of debt for TSMC.

The **unlevered beta** was estimated again through the comparables method of 15 companies operating in the same sector and in developed countries. The

average levered beta was calculated using the average unlevered beta of the comparables.

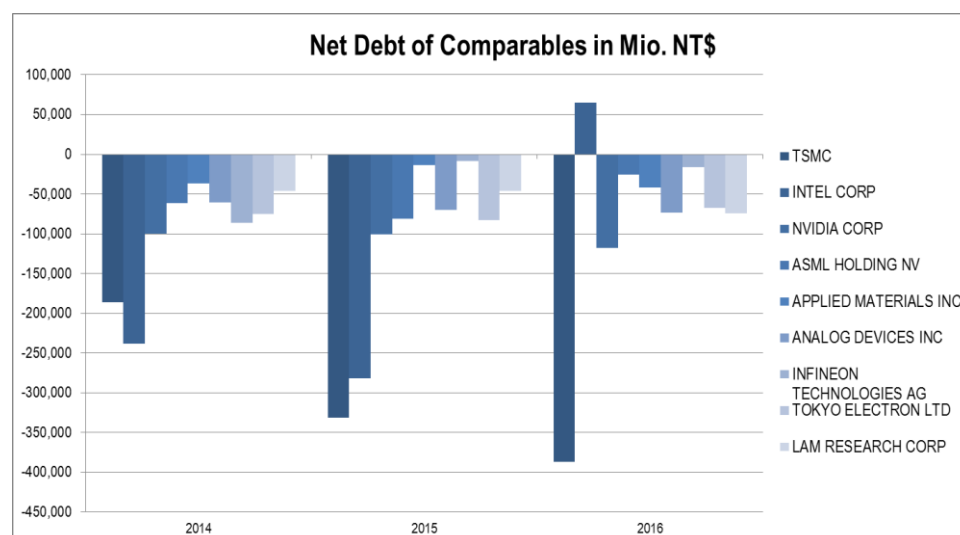
Comparables	Beta Unlevered
TSMC	0.68
INTEL CORP	0.93
BROADCOM LTD	1.30
NVIDIA CORP	1.80
QUALCOMM INC	1.00
TEXAS INSTRUMENTS INC	0.90
ASML HOLDING NV	1.38
APPLIED MATERIALS INC	1.36
SK HYNIX INC	0.70
NXP SEMICONDUCTORS NV	0.71
MICRON TECHNOLOGY INC	1.26
ANALOG DEVICES INC	1.20
INFINEON TECHNOLOGIES AG	1.43
TOKYO ELECTRON LTD	1.55
LAM RESEARCH CORP	0.98

In 2016, TSMC's level of financial debt as percentage of revenues was 26%, compared to 31% of operating cash. To illustrate the level of net debt of TSMC, a comparable analysis with eight companies has been performed. The strong increase of net debt from 2014 to 2016, is due to the fact that TSMC held high levels of cash to sustain the need for working capital, for capex purposes, for the repayment of debt and for the payment of dividends.

The market risk premium was calculated using TSMC's daily market returns with its respective country risk-free rates since 2012 and the returns from the 10-year US T-Bond, resulting in an annual market risk premium of 5.9%.

After considering the Debt/Enterprise value and the cost of levered equity a WACC of 7.6% has been achieved.

Average Beta Unlevered	1.15
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Source: Bloomberg

Multiples Valuation

The multiples analysis was performed on peers of TSMC operating in the semiconductor industry worldwide comprising eleven competitors excluding outliers. The focus of this analysis is on enterprise values including the Price/Earnings ratio. This is due to the fact that enterprise multiples allow for better comparison between different firms, regardless of capital structure. Equity multiples such as the P/E ratio is influenced by leverage.

The EV/EBITDA multiple which removes the effect of non-cash related expenses such as depreciation and amortization is below the industry average of 10.6x,

indicating that TSMC is undervalued. This is supported by the low EV/EBIT multiple which is below the industry average of 14.5x. Regarding the observed P/E multiple of 14.1x for TSMC compared to the industry average of 19.0x, TSMC can be classified as a value stock which supports the status of being undervalued. Overall it is a bargain and results in a “HOLD” recommendation, due to the classification of a relatively mature status of TSMC in the semiconductor industry.

Ticker	Name	EV/Sales 2016	EV/EBITDA 2016	EV/EBIT 2016	EBITDA-Margin 2016	EBIT-Margin 2016	P/E 2016
2330 TT Equity	TAIWAN SEMICONDUCTOR MANUFAC	4.6x	7.2x	11.4x	0.6x	0.4x	14.1x
INTC US Equity	INTEL CORP	2.9x	8.4x	13.5x	0.3x	0.2x	16.7x
NVDA US Equity	NVIDIA CORP	2.6x	13.6x	17.2x	0.2x	0.1x	27.0x
QCOM US Equity	QUALCOMM INC	3.0x	8.8x	10.7x	0.3x	0.3x	15.7x
TXN US Equity	TEXAS INSTRUMENTS INC	5.5x	12.7x	15.2x	0.4x	0.4x	20.3x
ASML NA Equity	ASML HOLDING NV	6.4x	21.4x	26.1x	0.3x	0.2x	29.8x
AMAT US Equity	APPLIED MATERIALS INC	2.7x	11.4x	13.4x	0.2x	0.2x	17.5x
000660 KS Equity	SK HYNIX INC	1.8x	4.0x	9.4x	0.4x	0.2x	10.4x
ADI US Equity	ANALOG DEVICES INC	4.9x	13.6x	16.4x	0.4x	0.3x	22.2x
IFX GR Equity	INFINEON TECHNOLOGIES AG	2.6x	10.6x	22.2x	0.2x	0.1x	23.4x
LRCX US Equity	LAM RESEARCH CORP	1.8x	7.9x	10.1x	0.2x	0.2x	14.4x
8035 JP Equity	TOKYO ELECTRON LTD	1.6x	7.5x	8.8x	0.2x	0.2x	16.5x
Maximum		6.4x	21.4x	26.1x	0.6x	0.4x	29.8x
Mean		3.4x	10.6x	14.5x	0.3x	0.2x	19.0x
Median		2.8x	9.7x	13.5x	0.3x	0.2x	17.1x
Minimum		1.6x	4.0x	8.8x	0.2x	0.1x	10.4x
Count		12	12	12	12	12	12

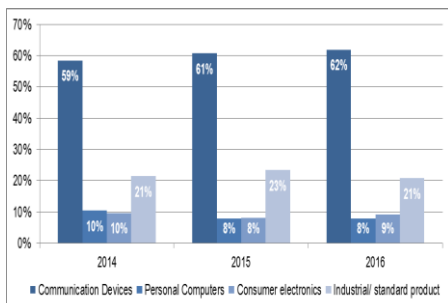
Sensitivity Analysis

A sensitivity analysis was conducted on the target price with the terminal growth rate and the WACC as the discount rate. Although the critical values considered in this sensitivity analysis are unlikely to appear it nonetheless shows the higher impact of the WACC on the target price than the growth rates. Unlike the cost of debt, the risk-free rate and the unlevered beta has an effect on the WACC. As the risk-free rate has a relatively low impact on the WACC compared to the unlevered beta. The unlevered beta was calculated using the raw beta of comparable companies and was unlevered to provide information on systematic risk of the industry after removing debt. As the average unlevered industry beta of 1.15 is higher than the unlevered beta of 0.68 of TSMC most volatility comes from it.

Sensitivity Analysis						
Growth rates						
WACC		3.5%	4.0%	4.5%	5.0%	5.5%
	7.6%	183.6	166.7	166.7	183.6	233.8
	8.1%	164.6	151.2	151.2	164.6	202.6
	8.6%	136.8	127.9	127.9	136.8	160.6
	9.1%	109.8	104.4	104.4	109.8	123.4

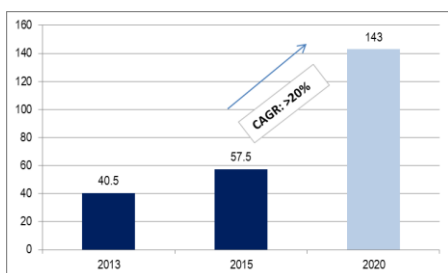
Potential Threats

Exhibit 20: Revenues by application type as % of total revenues.



Source: Annual report

Exhibit 21: Chinese Integrated Revenue Projection in USD bn.



Source: CSIA, SEMI

Exhibit 22: Historical Earthquakes in Taiwan

Date	Location	Deaths	Injuries
26.12.2006	Pingtung	2	0
19.12.2009	Hualien	0	6
04.03.2010	Koahsiung	0	96
26.02.2012	Pingtung	0	0
27.03.2013	Island-wide	1	97
02.06.2013	Island-wide	5	18
31.10.2013	Hualien	0	0
20.04.2015	Taipei	1	0
06.02.2016	Tainan	117	550
10.02.2017	Taipei	0	4

Source: US Geological Survey

Potential risks can arise from several sources. As stated previously, the main drivers for TSMC and other companies operating in the semiconductor sector are technological innovations in several industries such as the communication, the automotive, the consumer electronics and data processing industry. A **technological shift** in any of these industries may cut revenue inflows for TSMC. On the other hand, as TSMC delivers its products to end sellers it will certainly be able to anticipate those trends and can take competitive advantage out of it. In 2016 approximately 62% of TSMC's revenues came from communication devices and 21% from industrial standard products. Drop downs in sales of smartphones or industrial products can decrease profitability and increase factory downtime. As TSMC operates with high CAPEX intensity this can cause operational shut downs and increase cost of goods sold and labour costs.

Combined with its high **market share** of ca. 58% in the pure-play foundry business it has a stable market position. Nevertheless, threats arise from IDM's and fabless semiconductor companies. Intel Corp. implemented the foundry model to increase its margins. Still it will not be able to directly compete with TSMC as clients are not ready to pay a premium to other foundries.

In recent years the **Chinese government** launched investments to fund semiconductor companies through the National IC Industry Investment Fund. This fact will certainly shape the semiconductor industry internationally. China might implement restrictions to Taiwan to lower competition from the island state. Moreover, TSMC's clients may increase price pressure in terms of negotiations as more alternative foundry businesses may grow in the near future. In the short-run competitive threats may stay low but can increase in the medium to long-term.

Taiwan's **geographical** position incurs risks to its business. In 2016, an earthquake slowed down production increasing COGS. Future earthquakes may have a negative effect on semiconductor productions leading to higher overall costs. This threat is plausible considering that the majority of TSMC's fabs is located in Taiwan and can lead to production shortages but also to shortages in electricity and water supplies.

Appendix

Financial Statements

Income Statement

in Mio. NT\$	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Forecast 2017	Forecast 2018	Forecast 2019	Forecast 2020	Forecast 2021	Forecast 2022
Net Revenue	506,745	597,024	762,806	843,497	947,938	1,041,474	1,132,682	1,216,155	1,321,619	1,435,255	1,559,115
Cost of Revenue	(262,608)	(316,079)	(385,084)	(433,102)	(473,106)	(534,281)	(581,071)	(623,893)	(677,997)	(736,293)	(799,834)
Gross Profit	244,137	280,945	377,722	410,395	474,832	507,193	551,610	592,261	643,622	698,962	759,281
Operating Expenses											
Research and Development Expenses	(40,383)	(48,118)	(56,829)	(65,545)	(71,208)	(80,738)	(87,808)	(94,279)	(102,455)	(111,265)	(120,866)
General and administrative	(17,633)	(18,882)	(18,934)	(17,257)	(19,795)	(27,617)	(30,036)	(32,249)	(35,046)	(38,059)	(41,343)
Marketing	(4,496)	(4,505)	(5,087)	(5,665)	(5,901)	(7,504)	(8,162)	(8,763)	(9,523)	(10,342)	(11,234)
Total Operating Expenses	(62,512)	(71,505)	(80,850)	(88,467)	(96,904)	(115,859)	(126,006)	(135,292)	(147,024)	(159,665)	(173,444)
Other Operating Income and Expenses	(449)	47	(1,002)	(1,880)	30	0	0	0	0	0	0
Income from Operations	181,176	209,487	295,870	320,048	377,958	391,333	425,605	456,970	496,598	539,297	585,837
Non-Operating Income and Expenses											
Share of Profits of Associates and Joint Venture	2,073	3,972	3,951	4,132	3,495	4,000	4,000	4,000	4,000	4,000	4,000
Interest Expenses	(1,020)	(2,647)	(3,236)	(3,190)	(3,306)	(3,306)	(3,306)	(3,306)	(3,306)	(3,306)	(3,306)
Other Gains and Losses	(554)	4,733	5,494	29,439	7,812	7,812	7,812	7,812	7,812	7,812	7,812
Total Non-Operating Income and Expense	499	6,058	6,209	30,381	8,001	8,506	8,506	8,506	8,506	8,506	8,506
Income before Income Tax	181,675	215,545	302,079	350,429	385,959	399,839	434,111	465,476	505,104	547,803	594,343
Income Tax Expense	(15,552)	(27,468)	(38,315)	(43,873)	(51,621)	(53,477)	(58,061)	(62,256)	(67,556)	(73,267)	(79,492)
Net Income	166,123	188,077	263,764	306,556	334,338	346,362	376,050	403,220	437,548	474,536	514,851
Other Comprehensive Income (Loss)	4,252	16,352	11,805	(14,714)	(11,067)	0	0	0	0	0	0
Comprehensive Income	170,375	204,429	275,569	291,842	323,271	346,362	376,050	403,220	437,548	474,536	514,851

Balance Sheet

in Mio. NT\$	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Forecast 2017	Forecast 2018	Forecast 2019	Forecast 2020	Forecast 2021	Forecast 2022
Cash and cash Equivalents	143,411	242,695	358,449	562,689	541,254	575,047	660,433	784,047	961,606	1,190,725	1,458,502
Investments in Marketable Financial instruments	7,507	2,647	78,475	23,474	90,855	90,855	90,855	90,855	90,855	90,855	90,855
Accounts receivable	58,131	71,942	115,048	85,565	129,305	129,952	141,333	151,748	164,908	179,087	194,542
Inventories	37,831	37,495	66,338	67,052	48,682	64,289	69,919	75,072	81,582	88,597	96,242
Other current assets	3,446	3,708	8,256	7,964	7,633	8,608	9,362	10,052	10,924	11,863	12,887
Total current assets	250,326	358,487	626,566	746,744	817,729	868,751	971,902	1,111,775	1,309,875	1,561,127	1,853,029
Long-term investments	65,717	89,184	30,056	34,994	46,154	46,154	46,154	46,154	46,154	46,154	46,154
Property, Plant and Equipment	617,562	792,666	818,199	853,470	997,778	1,134,726	1,239,942	1,320,780	1,382,887	1,430,603	1,467,264
Intangible and Other non-current Assets	27,750	22,718	20,228	22,310	24,794	27,429	30,140	32,821	35,712	38,829	42,203
Total non-current assets	711,029	904,568	868,483	910,774	1,068,726	1,208,309	1,316,236	1,399,755	1,464,753	1,515,586	1,555,621
Total assets	961,355	1,263,055	1,495,049	1,657,518	1,886,455	2,077,060	2,288,138	2,511,529	2,774,628	3,076,713	3,408,649
Short-term loans	34,715	15,645	36,159	39,474	57,958	57,958	57,958	57,958	57,958	57,958	57,958
Accounts payable	15,239	16,359	23,370	19,725	27,325	29,254	31,816	34,161	37,124	40,316	43,795
Payables to Contractors and Equipment Suppliers	44,832	89,810	26,980	26,012	63,154	76,773	83,496	89,649	97,424	105,800	114,931
Accrued Expenses and Other current liabilities	53,560	67,964	114,505	103,500	131,692	148,720	161,745	173,665	188,725	204,952	222,639
Current portion of Bonds Payable and Bank Loans	128	0	0	23,518	38,110	38,110	38,110	38,110	38,110	38,110	38,110
Total current liabilities	148,474	189,778	201,014	212,229	318,239	350,816	373,125	393,543	419,340	447,136	477,432
Bonds Payable	80,000	210,768	213,674	191,965	153,094	153,094	153,094	153,094	153,094	153,094	153,094
Other non-current Liabilities	9,787	14,734	34,033	30,690	25,071	25,071	25,071	25,071	25,071	25,071	25,071
Total non-current liabilities	89,787	225,502	247,707	222,655	178,165	178,165	178,165	178,165	178,165	178,165	178,165
Capital Stock at Par Value	259,245	259,286	259,297	259,304	259,304	259,303	259,303	259,303	259,303	259,303	259,303
Capital Surplus	55,675	55,859	55,990	56,300	56,272	56,023	56,023	56,023	56,023	56,023	56,023
Legal Capital Reserve	115,820	132,436	151,251	177,641	208,298	208,298	208,298	208,298	208,298	208,298	208,298
Special Capital Reserve	7,606	2,786	0	0	0	0	0	0	0	0	0
Unappropriated Earnings	284,985	382,971	553,914	716,653	863,710	1,022,791	1,211,560	1,414,533	1,651,835	1,926,124	2,227,764
Others	(2,780)	14,170	25,749	11,774	1,664	1,664	1,664	1,664	1,664	1,664	1,664
Equity Attributable to Shareholders of the Parent	720,551	847,508	1,046,201	1,221,672	1,389,248	1,548,079	1,736,848	1,939,821	2,177,123	2,451,412	2,753,052
Non-controlling interests	2,543	267	127	962	803	0	0	0	0	0	0
Total Shareholders' Equity	723,094	847,775	1,046,328	1,222,634	1,390,051	1,548,079	1,736,848	1,939,821	2,177,123	2,451,412	2,753,052
Total Liabilities & Shareholders' Equity	961,355	1,263,055	1,495,049	1,657,518	1,886,455	2,077,060	2,288,138	2,511,529	2,774,628	3,076,713	3,408,649

Cash Flow

in Mio. NT\$	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Forecast 2017	Forecast 2018	Forecast 2019	Forecast 2020	Forecast 2021	Forecast 2022
EBIT	209,487	295,870	320,048	377,958	391,333	425,605	456,970	496,598	539,297	585,837	
Notional Income Tax	(37,456)	(51,682)	(55,414)	(65,551)	(66,527)	(72,353)	(77,685)	(84,422)	(91,680)	(99,592)	
Tax Adjustment	11,071	14,451	16,801	15,318	14,495	15,738	16,875	18,311	19,859	21,547	
NOPLAT	183,102	258,640	281,435	327,725	339,302	368,990	396,160	430,488	467,476	507,791	
Depreciation	153,980	197,645	219,303	220,085	227,829	259,100	283,124	301,583	315,764	326,659	
Amortization	2,202	2,606	3,202	3,743	3,359	3,820	4,175	4,447	4,656	4,817	
Gross Free Cash Flow	339,284	458,891	503,941	551,553	570,491	631,910	683,459	736,517	787,895	839,267	
CAPEX	(331,286)	(225,785)	(257,777)	(368,136)	(368,136)	(368,136)	(368,136)	(368,136)	(368,136)	(368,136)	
Change in Working Capital	46,765	(85,775)	13,443	47,895	15,347	4,545	4,160	5,255	5,663	6,172	
Change in other assets & liabilities	(107,912)	(110,665)	(159,602)	(65,209)	(36,427)	(88,097)	(126,296)	(180,450)	(232,235)	(271,152)	
Operating Free Cash Flow	(53,149)	36,667	100,005	166,103	181,274	180,221	193,186	193,186	193,186	206,151	
Share of Profits of Associates and Joint Venture	3,972	3,951	4,132	3,495	4,000	4,000	4,000	4,000	4,000	4,000	
Other Gains and Losses	4,733	5,494	29,439	7,812	7,812	7,812	7,812	7,812	7,812	7,812	
Tax Shield	(1,556)	(1,650)	(5,813)	(1,961)	(2,008)	(2,008)	(2,008)	(2,008)	(2,008)	(2,008)	
Non-Operating Free Cash Flow	7,149	7,795	27,758	9,346	9,804	9,804	9,804	9,804	9,804	9,804	
Total Cash Flow available to Investors	(46,000)	44,462	127,764	175,449	191,078	190,025	202,990	202,990	202,990	215,955	
Interest	(2,647)	(3,236)	(3,190)	(3,306)	(3,306)	(3,306)	(3,306)	(3,306)	(3,306)	(3,306)	
Tax Shield	473	565	552	573	562	562	562	562	562	562	
Change in Financial Debt	111,570	23,420	5,124	(5,795)	0	0	0	0	0	0	
Net Change in Equity (in Cash)	(61,120)	(65,071)	(131,085)	(166,762)	(187,531)	(187,281)	(200,246)	(200,246)	(200,246)	(213,211)	
Change in noncontrolling interest	(2,276)	(140)	835	(159)	(803)	0	0	0	0	0	
Total Cash Flows from Investors	46,000	(44,462)	(127,764)	(175,449)	(191,078)	(190,025)	(202,990)	(202,990)	(202,990)	(215,955)	

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Hold	Expected total return (including expected capital gains and expected dividend yield) between 0% and 15% over a 12-month period.
Sell	Expected negative total return (including expected capital gains and expected dividend yield) over a 12-month period.

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